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NDRI-PR 81-10  
November 1981

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**SUMMARIES OF RESEARCH,  
FISCAL YEAR 1981**

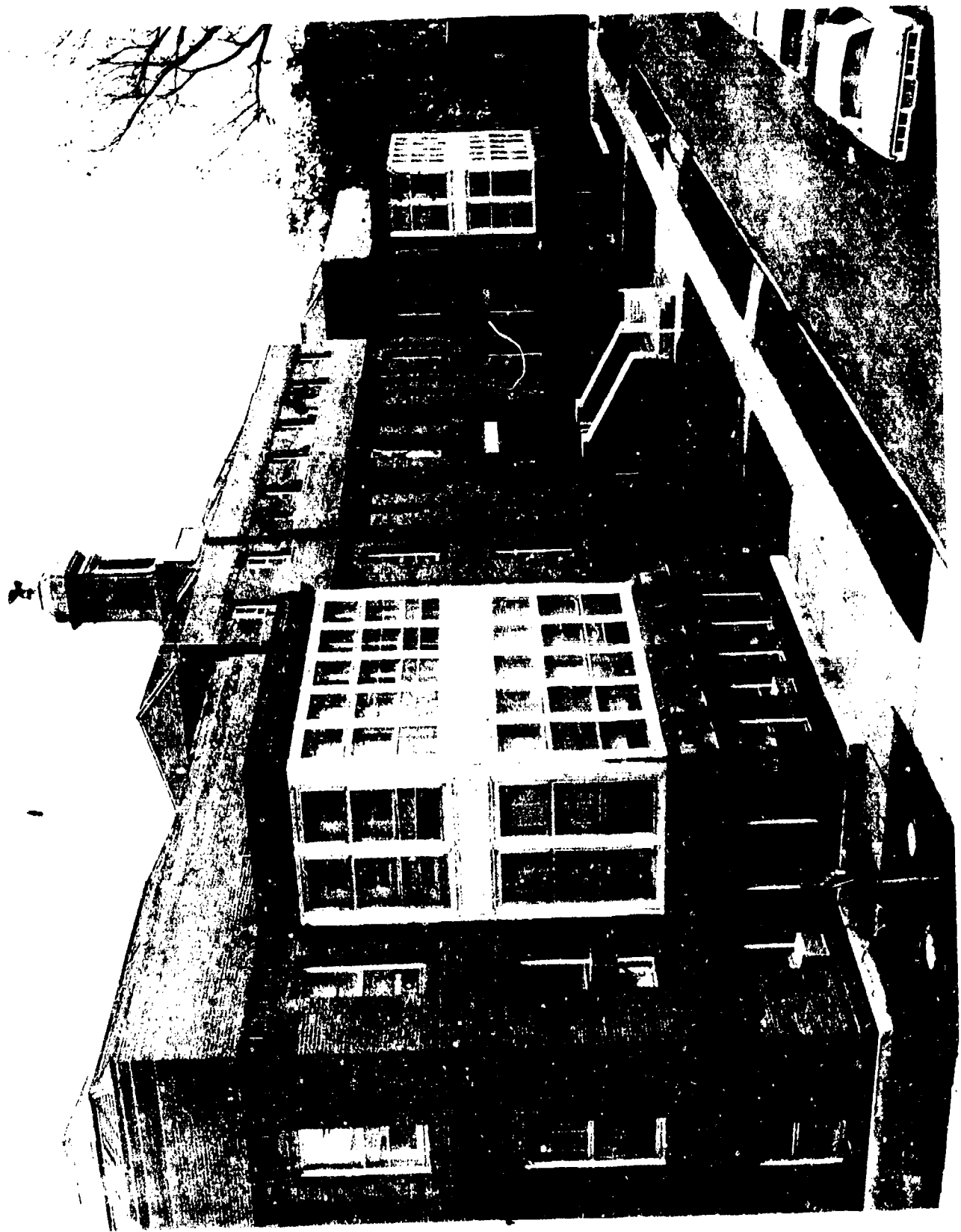
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Naval Medical Research and Development Command  
Bethesda, Maryland

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NAVAL DENTAL RESEARCH INSTITUTE  
NAVAL BASE, BLDG. 1-H  
GREAT LAKES, ILLINOIS 60088

SUMMARIES OF RESEARCH  
Fiscal Year 1981

These summaries cover research carried out from 01 October 1980 through 30 September 1981.

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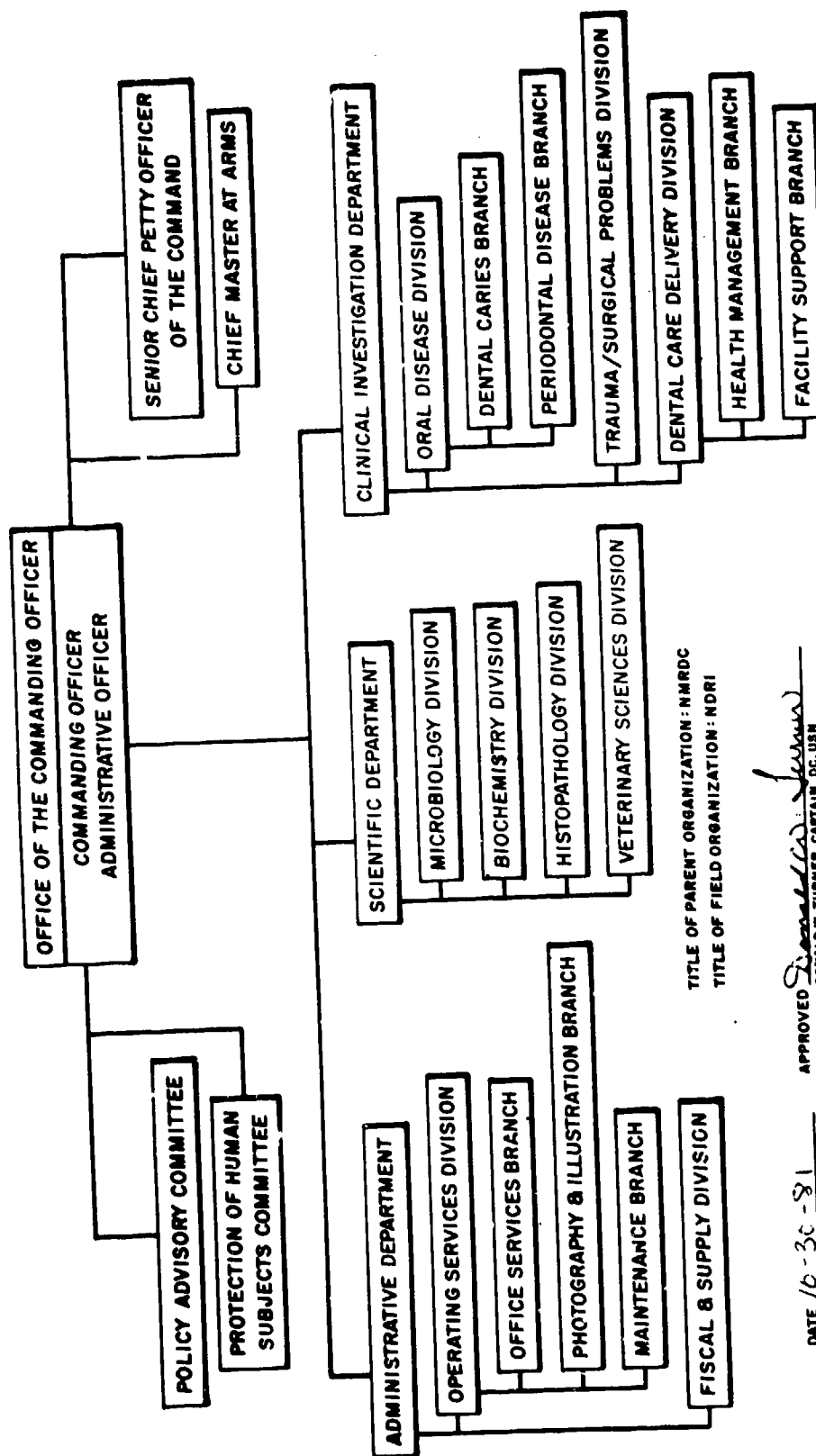
  
D. W. TURNER  
Captain, DC, USN  
Commanding Officer

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# NAVAL DENTAL RESEARCH INSTITUTE



DATE 16-30-81

APPROVED *Donald W. Turner*  
DONALD W. TURNER, CAPTAIN, DC, USN

## MISSION

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### COMMAND

The Naval Dental Research Institute was officially established 01 January 1967. The command was developed from the Dental Research Facility, which was a Division of the Dental Department of the Naval Administrative Command, Naval Training Center, Great Lakes.

### MISSION

The mission of the Institute is to conduct research, development, test and evaluation in dental and allied sciences, with particular emphasis on problems of dental and oral health in Navy and Marine Corps populations and on problems of fleet and field dentistry.

### PERSONNEL

As of 30 September 1981, there were on board 14 commissioned officers, 14 civilian employees, and 19 enlisted members, including assigned Air Force members.

### ORGANIZATION

The Institute has undergone some reorganization since 1967. The current organization of three major Departments is reflected on the preceding page. The Scientific Department consists of the Microbiology, Biochemistry, Histopathology, and Veterinary Sciences Divisions. Respectively, they carry out required microbiological, serological and bacteriological analysis; biochemical studies of etiological agents and of host factors involved in oral diseases; assistance, advice and preparation of specimens for histological analysis; and research in the field of laboratory animal medicine and dentistry. The Clinical Investigation Department conducts research related to prevention and treatment of dental and oral diseases with primary emphasis directed toward acute and chronic infections, problems of dento-alveolar trauma and injury, and the delivery of optimal dental care for the naval population. The Administrative Department provides the Institute with supply and fiscal services; library, general clerical services and manuscript preparation; photography and graphics; and equipment and facility maintenance, as well as special fabrications and instrumentation support.

FORMAL PRESENTATIONS OF RESEARCH MADE AT MEETINGS OF SCIENTIFIC SOCIETIES  
RESULTS REPORTED AND/OR DISCUSSIONS LED

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OCTOBER

AKER, F. presented "The Threat and NDRI's Response," to Reserve Group  
CRU MED 313.

CLARK, G. E. presented "Treatment of "U" Lesions at the Recruit Dental  
Clinic, Great Lakes, Illinois, Current Results of Annual Recall  
Information," at the Recruit Dental Clinic, Great Lakes, IL.

NOVEMBER

WIRTHLIN, M. R. presented "Experimental Treatment of Diseased Root  
Surfaces," to the Illinois Society of Periodontists.

JANUARY

WIRTHLIN, M. R. presented "Biologic Treatment of Diseased Root Surfaces,"  
at an oral biology seminar at the University of Illinois.

FEBRUARY

SCHROEDER, D. C. presented "Development of Criteria for the Extraction  
of Third Molars" to the Naval Dental Research Institute.

WIRTHLIN, M. R. presented "Flap Curettage and Biological Treatment of  
Diseased Root Surfaces in Monkeys," at the Chicago Section of the  
American Association for Dental Research.

MARCH

The 59th General Session of the International Association for Dental  
Research meeting held in Chicago, Illinois was attended by the  
following staff personnel:

AKER, F. presented "Effects of a Marine Environment on Dental  
Instruments and Supplies."

CECIL, J. C. presented "Salivary S. mutans and Lactobacillus  
Levels Related to Adult Caries Incidence."

COHEN, M. E. presented "Characteristics of Responders and Non-  
Responders to a Dental Recall Notice."

ESQUIRE, R. G. presented "Interproximal Plaque S. mutans and  
Caries Experience in Young Adults."

LAMBERTS, B. L. presented "Salivary pH-Rise Profiles of Caries-  
Free and Caries-Active Naval Recruits."

FORMAL PRESENTATIONS OF RESEARCH MADE AT MEETINGS OF SCIENTIFIC SOCIETIES  
RESULTS REPORTED AND/OR DISCUSSIONS LED (Continued)

MARCH (Continued)

MUELLER, E. J. presented "Inhibition of Specific Periodontopathic Bacteria by Surface Active Agents."

REESE, W. V. presented "The Effect of Alexidine Dihydrochloride on the Loss of Alveolar Bone in the Rice Rat."

SHKLAIR, I. L. presented "The Inhibitory Effect of Various Compounds on S. mutans Glucosyltransferase Activity."

SIMONSON, L. G. presented "Prevention of Experimental Dental Caries in Hamsters by a Bacterial  $\alpha$ -1, 3-Glucanase."

WALTER, R. G. presented "A Longitudinal Study of Caries Development in Initially Caries-Free Naval Recruits."

WIRTHLIN, M. R. presented "Regeneration After Biologic Treatment of Root Surfaces in Monkeys."

AKER, F. presented "Impact of Disease on Western Civilization" at the Veterans Administration Medical Center, North Chicago, IL.

CLARK, G. E. Presented "Diagnosis and Treatment of Deep Carious Lesions in Naval Recruits" at the Military Symposium "Advances in the Diagnosis and Treatment of Oral Disease/Injuries of Special Interest to the Military" at the 99th General Session of the International Association for Dental Research, Chicago, IL.

APRIL

AKER, F. presented "Medical Aspects of NBC Warfare" at the Naval Regional Dental Center, Casualty Care Course, Great Lakes, Illinois.

SCHROEDER, D. C. presented "Cutaneous Wound Healing," to the Naval Dental Research Institute.

MAY

AKER, F. presented a table clinic "Portable Dental Equipment" at the Great Lakes Dental Society Meeting.

AKER, F. presented a table clinic "Portable Dental Equipment" at the Wisconsin Dental Society Meeting in Milwaukee, Wisconsin.

WIRTHLIN, M. R. presented "Naval Dental Research" to the Reserve Readiness Command Region 13 Reserve Weekend Seminar at Great Lakes, Illinois.



FORMAL PRESENTATIONS OF RESEARCH MADE AT MEETINGS OF SCIENTIFIC SOCIETIES  
RESULTS REPORTED AND/OR DISCUSSIONS LED (Continued)

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MAY (Continued)

SCHROEDER, D. C. presented "Forensic Dentistry" for the Casualty Treatment Training course at the Naval Regional Medical Center, Great Lakes, IL.

JUNE

CLARK, G. E. presented "Mission and Goals of the Naval Dental Research Institute and Studies Being Conducted to Obtain Goals," at Service School Command, Great Lakes, Illinois.

SCHROEDER, D. C. presented "Review of Anatomy" at the Basic Cardiac Life Support instructors' course at Victory Hospital, Waukegan, Illinois.

SCHROEDER, D. C. presented "Results of Third Molar Study" to the Naval Dental Research Institute.

AUGUST

TURNER, D. W. presented "The Naval Dental Research Program" to a group of periodontists from Central and South American countries visiting dental facilities in the United States.

SEPTEMBER

WALTER, R. G. and SHKLAIR, I. L. presented "The Effect of Low Molecular Weight Dextran on Dental Caries and Plaque in Rats and Hamsters," at the Workshop of Food, Nutrition and Dental Health of the American Dental Association Health Foundation, Chicago, Illinois.

## PARTICIPATION IN OTHER PROGRAMS

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### OCTOBER

The American Dental Association National Convention held in New Orleans, Louisiana was attended by:

AKER, F.  
CECIL, J. C.

CECIL, J. C. attended the American Association of Public Health Dentists meeting in New Orleans, Louisiana.

CLARK, G. E. attended the Edgar D. Coolidge Endodontic Study Club in Chicago, Illinois.

COOPER, J. R. attended the annual meeting of the American Association for Laboratory Animal Science in Indianapolis, Indiana.

COHEN, M. E. attended the BMDP Statistical Software seminar in Chicago, Illinois.

A meeting of the Chicago Section of the American Association for Dental Research was attended by the following personnel:

ESQUIRE, R. G.  
SHKLAIR, I. L.  
WIRTHLIN, M. R.

SEROWSKI, A. attended the mid-regional meeting of the Association for the Advancement of Medical Instrumentation in Philadelphia, PA.

SHKLAIR, I. L. attended the Conference of Foods, Nutrition, and Dental Health at the American Dental Association, Chicago, Illinois.

WIRTHLIN, M. R. attended the American Academy of Periodontology in St. Louis, Missouri.

LARSON, E. W. attended the Aspects of Medical Photography in Dallas, Texas.

### NOVEMBER

The Great Lakes Dental Society meeting was attended by the following personnel:

AKER, F.	SCHROEDER, D. C.
BAYCAR, R. S.	WIRTHLIN, M. R.
ESQUIRE, R. G.	

A meeting of the Chicago Section of the American Association for Dental Research was attended by the following personnel:

CLARK, G. E.  
WIRTHLIN, M. R.

PARTICIPATION IN JTF-R PROGRAMS (Continued)

NOVEMBER (Continued)

A Sigma Xi seminar at Abbotts Laboratories, North Chicago, Illinois was attended by the following personnel:

CLARK, G. E.  
SCHROEDER, D. C.

PORVAZNIK, M. attended the 20th annual meeting for the American Society for Cell Biology in Cincinnati, Ohio.

SHKLAIR, I. L. attended a meeting of the Plaque Resource Committee Group of the American Dental Association Health Foundation, Chicago, Illinois.

SCHROEDER, D. C. attended an oral pathology seminar at the Naval Regional Medical Center, Great Lakes, Illinois.

DECEMBER

A seminar on Diagnosis of Radiographic Lesions at the Naval Regional Dental Center, Great Lakes, Illinois was attended by the following personnel:

CECIL, J. C.  
CLARK, G. E.

JANUARY

The Great Lakes Dental Society meeting was attended by the following personnel:

AKER, F.	CLARK, G. E.
BAYCAR, R. S.	SCHROEDER, D. C.
CECIL, J. C.	WIRTHLIN, M. R.

SCHROEDER, D. C. attended an oral pathology seminar at the Naval Regional Medical Center, Great Lakes, Illinois.

FEBRUARY

A Navy Reserve Luncheon in conjunction with the Mid-Winter Chicago Dental Society Meeting was attended by the following personnel:

AKER, F.	SCHROEDER, D. C.
BAYCAR, R. S.	SEROWSKI, A.
CECIL, J. C.	WALTER, R. G.
ESQUIRE, R. G.	WIRTHLIN, M. R.

PARTICIPATION IN OTHER PROGRAMS (Continued)

FEBRUARY (Continued)

A meeting of the Chicago Section of the American Association for Dental Research was attended by the following personnel:

BAYCAR, R. S.	LAMBERTS, B. L.
CECIL, J. C.	SIMONSON, L. G.
CLARK, G. E.	WALTER, R. G.
ESQUIRE, R. G.	

A lecture series presented by the Naval Regional Dental Center, Great Lakes, Illinois was attended by:

BAYCAR, R. S.  
CECIL, J. C.  
ESQUIRE, R. G.

SCHROEDER, D. C. attended two oral pathology seminars at the Naval Regional Medical Center, Great Lakes, Illinois.

WIRTHLIN, M. R. attended the Midwest Society of Periodontology in Chicago, Illinois.

MARCH

The International Association for Dental Research meeting held in Chicago, Illinois was attended by the following personnel:

BAYCAR, R. S.	PORVAZNIK, M.
ESQUIRE, R. G.	SHKLAIR, I. L.

SIMONSON, L. G. attended the American Society for Microbiology annual session in Dallas, Texas.

SCHROEDER, D. C. attended three oral pathology seminars at the Naval Regional Medical Center, Great Lakes, Illinois.

APRIL

The American Society of Mechanical Engineers convention held in Chicago, Illinois was attended by:

AKER, F.  
SEROWSKI, A.

The Chicago Section of the American Association for Dental Research was attended by:

CECIL, J. C.  
CLARK, G. E.  
WIRTHLIN, M. R.

PARTICIPATION IN OTHER PROGRAMS (Continued)

APRI: (Continued)

The Great Lakes Dental Society meeting was attended by the following personnel:

CLARK, G. E.	WIRTHLIN, M. R.
ESQUIRE, R. G.	

ESQUIRE, R. G. attended the California Dental Society meeting in Anaheim, California.

LAMBERTS, B. L. attended a meeting of Sigma Xi at Lake Forest College, Lake Forest, Illinois.

SCHROEDER, D. C. attended four oral pathology seminars at the Naval Regional Medical Center, Great Lakes, Illinois.

MAY

The Great Lakes Dental Society meeting was attended by:

AKER, F.	CLARK, G. L.
BAYCAR, R. S.	ESQUIRE, R. G.
CECIL, J. C.	SCHROEDER, D. C.

AKER, F. attended the Wisconsin Dental Society meeting held in Milwaukee, Wisconsin.

The Chicago Section of the American Association for Dental Research meeting hosted by the Naval Dental Research Institute was attended by:

AKER, F.	LAMBERTS, B. L.
BAYCAR, R. S.	SCHROEDER, D. C.
CECIL, J. C.	SEROWSKI, A.
CLARK, G. E.	SHKLAIR, I. L.
ESQUIRE, R. G.	SIMONSON, L. G.

BAYCAR, R. S. attended the Casualty Care Course, Naval Regional Dental Center, Great Lakes, Illinois.

The Illinois Society for Microbiology meeting held at Triton College, River Grove, Illinois was attended by:

SHKLAIR, I. L.	ESQUIRE, R. G.
SIMONSON, L. G.	

SCHROEDER, D. C. attended a lecture series at the Naval Regional Dental Center, Great Lakes, Illinois.

WIRTHLIN, M. R. attended the Surgeon General's conference in Washington, D. C.

PARTICIPATION IN OTHER PROGRAMS (Continued)

MAY (Continued)

WIRTHLIN, M. R. attended the Naval Medical Research and Development Command conference in Washington, D. C.

JUNE

The International Society for Preventive Dentistry meeting in Chicago, Illinois was attended by:

CECIL, J. C.  
ESQUIRE, R. G.

LAMBERTS, B. L. attended the annual meeting of the American Society of Biological Chemists in St. Louis, Missouri.

A briefing on NBC Warfare at the Naval Regional Medical Center, Great Lakes, Illinois was attended by:

AKER, F.  
SCHROEDER, D. C.

JULY

AKER, F. attended the Academy of General Dentistry conference in Denver, Colorado.

AUGUST

SHKLAIR, I. L. attended a meeting of the Animal Resources Group for the Conference on Foods, Nutrition, and Dental Health of the American Dental Association, Chicago, Illinois.

PATTON, S. M. attended a Leadership and Management training course at Service School Command, Great Lakes, Illinois.

SCHROEDER, D. C. attended a lecture series at the Naval Regional Medical Center, Great Lakes, Illinois.

SEPTEMBER

The Chicago Section of the American Association for Dental Research was attended by:

CECIL, J. C.	SHKLAIR, I. L.
CLARK, G. E.	SIMONSON, L. G.
LAMBERTS, B. L.	TURNER, D. W.
SCHROEDER, D. C.	

SCHROEDER, D. C. attended the American Association of Oral and Maxillofacial Surgeons annual meeting in Washington, D. C.

PARTICIPATION IN OTHER PROGRAMS (Continued)

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SEPTEMBER (Continued)

BAILEY, G. L. attended COI instructor training at Service School  
Command, Great Lakes, Illinois.

SCHROEDER, D. C. attended a lecture series on Head and Neck Anatomy  
at the Naval Regional Medical Center, Great Lakes, Illinois.

WORK UNITS - FISCAL YEAR 1981

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- 61153N MR041.20.02 0441 - Prevention of Dental Disease in Naval and Marine Corps Personnel by Inhibiting Plaque Accumulation
- 62758N F58524 ZF58524012 0026 - Evaluation of Factors in Saliva and Plaque of Caries-Free Recruits of Potential Therapeutic Applicability for Preventive Dentistry
- 62758N ZF51.524.012 0027 - Development of Therapeutic Methods to Prevent Oral Disease of Naval and Marine Corps Personnel
- 62758N F58524 MF58.524.012 0028 - The Effect of Fluoride Rinse Use by Naval Recruits on Dental Plaque Fluoride Levels and Microbial Composition
- 62758N F58524 MF58524012 0029 - Therapeutic Control of Periodontopathic Microorganisms in Naval Personnel
- 62758N MF58.524.MF58.524.012 0030 - Monitoring the Oral Health Status of Naval Personnel
- 63706N M0095PN M0095PN003 3008 - Evaluation of Expedient Procedures for Treating Dental Pulp Disease in Naval Personnel
- 63706N M0095PN M0095PN003 3010 - Wound Healing of the Supporting Tissues of the Teeth of Naval and Marine Corps Personnel
- 63706N M00935.PN M00935PN003 3017 - Dental Equipment Development and Evaluation for Fleet Health Care
- 64771N M0933PN M0933PN002 0001 - Development of a Marine Corps Expeditionary Dental Shelter

INDEPENDENT RESEARCH WORK UNITS

- 61152N MR00001 MR0000101 0026 - The Relationship of Oral Health and Personnel Performance in Navy Recruits
- 61152N MR00001 MR0000101 0027 - Dental History Predictors of Caries Related Dental Emergencies
- 61152N MR00001 MR0000101 0028 - A Model for Wound Healing of Soft Tissue Tooth Interfaces of Naval and Marine Corps Personnel
- 61152N MR00001 MR0000101 0029 - Angulation, Age and Clinical Problems Associated with Retention and Extraction of Third Molars
- 61152N MR00001 MR0000101 0030 - Evaluation of Commercially Available Auxiliary Ballistic Protection Shields for Facial Combat Dress



WORK UNITS - FISCAL YEAR 1981 (Continued)

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61152N MR00001 MR0000101 - The Use of Antioxidants in the Treatment of  
Combat Burns

(New Project) - Evaluation of an Agent for Distinguishing Between Infected  
and Non-Infected Dentin of Deep Carious Lesions

RESEARCH PROGRESS REPORTS - FY 1981

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NDRI-PR 80-13	Summaries of Research (Fiscal Year 1980)
NDRI-PR 80-14	Influence of Interdental Contacts on Periodontal Status
NDRI-PR 80-15	Dextranase-Producing Organisms in Dental Plaque from Caries-Free and Caries-Active Naval Recruits
NDRI-PR 80-16	Research Abstracts of 1980
NDRI-PR 80-17	Relationship Between Dental Caries Experience and Surface Enamel Concentration in Young Men from Three Optimally Fluoridated Cities
NDRI-PR 80-18	Cold Weather Dentistry: A Review
NDRI-PR 80-19	<u>Streptococcus mutans</u> and Dental Disease in the Navy
NDRI-PR 81-01	A Comprehensive Review of New Attachment Therapy
NDRI-PR 81-02	Decreased Alveolar Bone Resorption in Rice Rats Treated with Chlorhexidine and Stannous Fluoride
NDRI-PR 81-03	Diagnostic Criteria for the Treatment of Caries-Induced Pulpitis
NDRI-PR 81-04	Fluoride Accumulation by Oral Microorganisms
NDRI-PR 81-05	Effect of Human Saliva and Various Compounds on the Adsorption of the Bacterium <u>Streptococcus mutans</u> to Hydroxyapatite
NDRI-PR 81-06	The Location of the Periodontal Probe Tip in Health and Disease
NDRI-PR 81-07	Production of $\alpha$ -1, 3-Glucanase by a New Bacterial Source ( <u>Pseudomonas</u> )
NDRI-PR 81-08	Glucan Synthesis by the Oral Bacterium <u>Streptococcus mutans</u> from Caries-Active and Caries-Free Naval Recruits

#### OTHER PUBLICATIONS

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- Finch, R. R., Aker, F. and Miller, R. L. The Inflammatory Reaction: A Program Workbook on the Sequence of Inflammation and its Modifications. Thompson Press, Indiana, 158 pages, 1980.
- Leonard, E. P., Reese, W. V., Benson, C. L. and Cecil, J. C. III. Decreased Alveolar Bone Resorption in Rice Rats Treated with Chlorhexidine and Stannous Fluoride. Journal of Periodontal Research 15:650-654, 1980.
- Seymour, F. R., Julian, R. L., Jeanes, A. and Lamberts, B. L. Structural Analysis of Insoluble D-glucans by Fourier-Transform, Infrared Difference-Spectrometry: Correlation between Structures of Dextrans from Strains of Leuconostoc mesenteroides and of D-glucans from Strains of Streptococcus mutans. Carbohydrate Research 86:227-246, 1980.
- Simonson, L. G., Lamberts, B. L. and Reiher, D. A. Production of  $\alpha$ -1, 3-Glucanase by a New Bacterial Source (Pseudomonas). Microbios Letters 14:107-112, 1980.
- Simonson, L. G. and Reiher, D. A. Effect of Human Saliva and Various Compounds on the Adsorption of the Bacterium Streptococcus mutans to Hydroxyapatite. Archives of Oral Biology 26:143-146, 1981.
- Shklair, I. L. and Gaugler, R. W. Glucan Synthesis by the Oral Bacterium Streptococcus mutans from Caries-Active and Caries-Free Naval Recruits. Archives of Oral Biology 26:683-686, 1981.

## DISTINGUISHED VISITORS

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### NOVEMBER

Captain A. D. Loizeaux, DC, USN, Director of Clinical Services, Naval Regional Dental Center, Pearl Harbor, Hawaii.

### DECEMBER

Dr. D. Chambers, School of Dentistry, University of Illinois, Chicago, Illinois.

Dr. S. Mukherjee, School of Dentistry, University of Illinois, Chicago, Illinois.

Dr. R. Cohen, School of Dentistry, University of Illinois, Chicago, IL.

Dr. Harvey W. Lyon, Stoughton, Wisconsin.

### JANUARY

RADM C. E. GURNEY III, Commander, Naval Training Center, Great Lakes, IL.

### FEBRUARY

Captain L. Muldrow, DC, USN, Naval Regional Dental Center, Great Lakes, Illinois.

Dr. Elizabeth Koch, University of Health Sciences/Chicago Medical School, North Chicago, Illinois.

### MARCH

Captain J. Nowak, DC, USNR-R, University of Iowa, School of Dentistry, Iowa City, Iowa.

LCDR T. Rocha, DC, USN, Naval Regional Dental Center, Great Lakes, Illinois.

The Naval Dental Research Institute held an Open House with the following visitors attending:

Dr. Joseph L. Streckfuss, University of Texas, Dental Branch, Houston, Texas.

Dr. Harris J. Keene, University of Texas, Dental Branch, Houston, Texas.

Dr. M. C. Alfano, Fairleigh Dickinson University, Hackensack, N. J.

Dr. J. Parlin, University of Louisville, Louisville, Kentucky.

Dr. M. E. Jensen, University of Minnesota, Minneapolis, Minnesota.

DISTINGUISHED VISITORS (Continued)

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MARCH (Continued)

Dr. G. R. Germaine, University of Minnesota, Minneapolis, Minnesota.

A. Y. Balekjian, Naval Medical Research Institute, National Naval Medical Center, Bethesda, Maryland.

Dr. C. F. Schachtele, University of Minnesota, Minneapolis, Minnesota.

Dr. J. A. Mayo, L.S.U. School of Dentistry, New Orleans, Louisiana.

Rashid Al-Hayali, School of Dentistry, Baghdad, Iraq.

Adnan H. Muhammed, School of Dentistry, Baghdad, Iraq.

J. R. Mellberg, Colgate-Palmolive Co., Piscataway, N. J.

LCDR J. Meiers, DC, USN, University of Minnesota, Minneapolis, Minnesota.

Captain E. P. Leonard, DC, USN, Naval Medical Research and Development Command, National Naval Medical Center, Bethesda, Maryland.

Captain D. W. Turner, DC, USN, Naval Medical Research Institute, National Naval Medical Center, Bethesda, Maryland.

Captain G. Triplett, DC, USN, Naval Medical Research Institute, National Naval Medical Center, Bethesda, Maryland.

Captain G. Branham, DC, USN, Naval Medical Research Institute, National Naval Medical Center, Bethesda, Maryland.

CDR W. Cunningham, DC, USN, Naval Medical Research Institute, National Naval Medical Center, Bethesda, Maryland.

LT B. Halverson, DC, USN, Naval Medical Research Institute, National Naval Medical Center, Bethesda, Maryland.

LT S. A. Leone, DC, USN, Naval Medical Research Unit 3, Cairo, Egypt.

CDR R. W. Gaugler, MSC, USN, Uniformed Services University of the Health Sciences, Bethesda, Maryland.

Professor H. L. Bailit, University of Connecticut, Farmington, Connecticut.

CDR J. J. Bial, DC, USN, Naval Regional Medical Center, Great Lakes, IL.

DISTINGUISHED VISITORS (Continued)

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MARCH (Continued)

LCDR J. E. Jones, NC, USN, Naval Regional Medical Center,  
Great Lakes, Illinois.

Captain E. L. Mosby, DC, USN, Naval Regional Medical Center,  
Great Lakes, Illinois.

CDR R. P. Rog, DC, USN, Naval Regional Medical Center, Great Lakes,  
Illinois.

LT G. L. Reinhart, DC, USN, Naval Regional Medical Center, Great  
Lakes, Illinois.

CDR J. J. Shanley, DC, USN, Naval Regional Medical Center,  
Great Lakes, Illinois.

LCDR M. J. Whitehouse, Naval Regional Medical Center, Great  
Lakes, Illinois.

APRIL

CDR H. White, MCDEC, Quantico, Virginia.

MAY

CDR B. Peterson, DC, USN, Naval Regional Dental Center, Great Lakes, IL.

Captain R. A. Esposito, DC, USN, Naval Regional Dental Center, Great  
Lakes, Illinois.

LT H. Tomas, MSC, USNR, University of Kentucky, Lexington, Kentucky.

JUNE

VADM J. William Cox, MC, USN, Surgeon General of the Navy, Washington,  
D. C.

LCDR S. R. Weinberg, MSC, USN, Armed Forces Radiobiology Research  
Institute, Bethesda, Maryland.

Captain E. Mateik, MSC, USN, Armed Forces Radiobiology Research  
Institute, Bethesda, Maryland.

Dr. B. Peri, University of Chicago, Chicago, IL.

Captain W. Voyles, DC, USN, Officer in Charge, Memphis Branch Clinic,  
Naval Regional Dental Center, Great Lakes, Illinois.

## DISTINGUISHED VISITORS (Continued)

### JULY

Captain P. Coombs, DC, USN, Commanding Officer, Naval Regional Dental Center, Orlando, Florida.

Captain J. E. Klima, DC, USN, Director of Clinical Services, Naval Regional Dental Center, Orlando, Florida.

Colonel D. V. Osborne, USAF/BSC, DOD Medical Support, Andrews Air Force Base, Maryland.

### AUGUST

The Naval Dental Research Institute was visited by a group of periodontists primarily from Central and South America. The group consisted of the following visitors:

Elda Lorenzo, Uruguay	Claudia Audrez, Chile
Lucia Bravo, Mexico	Hugo Minaya, Peru
Victoria Londono, Columbia	Jose Jesus Brerra, Mexico
Antonio Tamayoc, Columbia	Arturo Castillow, Guatemala
Varquez P. Santos, Brasil	Manuel Manjarres, Colombia
Lilian Lucy Trigo, Uruguay	Lourenco Bozzo, Brasil
Elene Gonzalez, Chile	Zeudo Ceizurco Vinna, Brasil
Sayed Ali Hussein, Sudan	Roberto B. Tagliavin, Brasil
Rodolfo H. Romer, Costa Rica	Sindfers Therguluc, Peru
M. Caenaedilli de Aenorin, Brasil	Jacobo Gomez, Mexico
Estela Santos Gusuiap, Brasil	Vera Lucia Pelanda, Brasil
Adantr Sett, Brasil	Martha de La Torre, Colombia
Antonio Bascowes, Spain	Otto Manuel Yanam, Guatemala
Jose Manlleo, Spain	Sergio Alvarado, Peru
Alfredo Malva, Spain	Mario Jimeno, Venezuela
Mario Jimeno, Venezuela	Walter A. Soares Machodo, Brasil
Edgar Pelaez, Colombia	

DISTINGUISHED VISITORS (Continued)

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AUGUST (Continued)

Captain G. E. Nieusma, Chief Dental Service, Naval Regional Medical Center, Great Lakes, Illinois.

SEPTEMBER

CDR D. Von Alderhoch, Naval Sea Systems Command, Washington, D. C.

Captain E. P. Leonard, DC, USN, Naval Medical Research and Development Command, National Naval Medical Center, Bethesda, Maryland.

Captain W. H. Hirschfeld, Bureau of Medicine and Surgery, Washington, D. C.

RADM C. F. Schreier, DC, USNR-R, Southampton, N. Y.



## STATEMENT OF SIGNIFICANT ACCOMPLISHMENTS

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### CLINICAL INVESTIGATION DEPARTMENT

#### (Oral Diseases Division)

Evaluation of conservative pulp treatment for teeth with deep carious lesions was still in progress during FY81. Phase I or the diagnostic phase was completed last fiscal year. The results of Phase I led to the defining of clinical criteria which are most valuable for predicting irreversible and reversible pulp disease. These criteria will be used retrospectively in the continuing Phase II study for the evaluation of methods and materials currently used in conservative pulp therapy. Additionally, the criteria will be used to select teeth with deep caries, but good healing potential, for Phase IV controlled studies.

Concerning Phase II or the long term assessment of current conservative pulp therapy, 753 "U"-lesion teeth in 474 recruits have been examined. History of symptoms, radiographic evaluation and pulp tests results have been recorded. Presently, clinical diagnostic data from 530 teeth are still maintained in the "U"-lesion records file. The distribution of "U"-lesion treatment for these teeth is outlined in the table below. Records for the remaining 173 teeth have been accounted for by reclassification of the severity of the carious lesion and deletions from the study. Reclassifications occur after careful radiographic examination and include placing the teeth in a category of lesions not severe enough to be designated "U"-lesion or a category of apparent pulp exposure. Deletions may result from discharges from active duty within the first year of active duty or refusal to continue participation in the study. According to the table below, there was no record of treatment for 130 teeth. Some of these may have been treated, but due to recruit company changes and failure to receive mailed recall responses, records are incomplete. The "no record of treatment" number has decreased by nine from last year at this time -- instead of increasing. This was due primarily to the new approach instituted February 1980, of conducting the initial examination of teeth early on the day the recruit's company is scheduled for dental treatment.

#### Distribution of Techniques for Treatment of 580 "U" Lesions at the Recruit Dental Clinic, Great Lakes, Illinois

Technique						
No Record of Treatment	All Caries Removed	Indirect Pulp Cap	Direct Pulp Cap	Pulpotomy	Root Canal Filling	Extraction
130	265	50	67	24	26	18

## STATEMENT OF SIGNIFICANT ACCOMPLISHMENTS (Continued)

### CLINICAL INVESTIGATION DEPARTMENT (Continued)

As of April 1981, recall data for one or more annual recall examinations up to four years was available for 190 teeth. This is an increase of 79 teeth from April 1980. This success/failure designation for conservative treatment of these teeth is summarized below. Failure criteria have been determined from formulation of clinical criteria predictive of irreversible pulpitis by Phase I results. The "U"-lesion treatment was considered a failure when the periodontal ligament (PDL) space was increasing from the previous examination; sclerosis was present on the radiograph and not present on earlier examinations; the PDL space was greater than 1 mm and not resolving from the previous examination; and there was history of pain duration greater than one hour or severe pain which interferes with daily activities or sleep. Additionally, failure was recorded when the tooth has been extracted for pulpal reasons, or when it has been retreated for reason of restoration failure, or provided a root canal filling.

#### Success Rates of Techniques for Conservative Treatment of "U"-Lesions at Recruit Dental Clinic, Great Lakes, Illinois

Recall Year	All Caries Removed		Indirect Pulp Cap		Direct Pulp Cap		All Treatment	
	%†	N	%	N	%	N	%	N
1	84	(74)	83	(18)	89	(18)	85	(110)
2	86	(56)	86	(7)	93	(14)	87	(77)
3	88	(35)	88	(8)	80	(10)	87	(53)
4	88	(16)	100	(6)	80	(5)	89	(27)

†Percent successful treatment of "U"-lesion teeth (total number of teeth).

The total number of teeth eligible for recall data decreased with each year up to recall year four. This was because teeth were continually and regularly introduced in the study as it progressed. Additionally, the current response for the past eight months to the mailed recall examination requests by the naval dental facilities was 49%. In actual experience this means, as an example, the study may have recall data for "U"-lesion treatment of a tooth at recall years one and three while no response to the recall request was received for year two.

As can be seen in the above table, overall treatment success for the conservative techniques of all caries removed without pulp cap consideration (ACR), indirect pulp cap (IPC), and direct pulp cap (DPC) varied between 85 and 89% for the years one to four. The success rate may appear to have increased with time for ACR and IPC. As more data accumulates for these treatments in the later recall years, this trend may or may not be continued. Also of note concerning this point, there are examples of treatment being classified as failure at one recall interval only to become successful at a subsequent interval because the periodontal ligament (PDL) space was found to be resolving and there was no pain history sufficient to be classified as unsuccessful.

## STATEMENT OF SIGNIFICANT ACCOMPLISHMENTS (Continued)

### CLINICAL INVESTIGATION DEPARTMENT (Continued)

There are now at least one recall examination available for 174 teeth treated by conservative methods. Of the 202 teeth in the study which were treated by conservative means and have progressed to at least their first post-treatment anniversary date, 174 teeth with at least one recall response translates to 86% of the teeth with at least one year post-treatment are represented in the data of the preceding table. Chi Square test of the data showed there was no significant difference among the ACR, IPC, and DPC treatments and recall years. Success was not dependent on the type of treatment.

#### Success Rates for Conservative Treatment of Deep Carious Lesions as a Function of Base Material, Base 1, on the Pulpal Floor of the Cavity Preparation

Recall Year	Dycal		Cavitec		IRM		All Treatment	
	%†	N	%	N	%	N	%	N
1	85	(85)	80	(10)	100	(1)	84	(96)
2	86	(67)	100	(3)	100	(1)	87	(71)
3	86	(49)	100	(2)	---	---	86	(51)
4	87	(23)	100	(2)	100	(1)	88	(26)

†Percent successful treatment (total number of teeth).

Since success was not dependent on the treatment type all the treatment material data for ACR, IPC, and DPC were grouped together as one type of treatment for correlation of the various materials with success or failure of treatment. The above table lists the success rates of the base materials (base 1) placed on the pulpal floor of the cavity preparation, while the table below lists the same rates for the base materials (base 2) used as an intermediary base between base 1 and the surface restorative material. In discussing base 1 materials, Dycal was by far the most often used base 1 material, and its use was associated with 85-87% success. While Cavitec was associated with 80-100% success, it was much less used and reflects considerably smaller data. The use of no base 2 has been the overwhelming choice by Great Lakes Recruit Dental Clinic personnel and no base 2 was associated with 85-90% success. Of the few times zinc phosphate has been used as a base 2, its use has been more variant in success, 50-100%. Of the few times Caulk IRM has been used as either base 1 or 2 its success has been high, between 86-100%. Dycal and IRM are the base materials to be used in the controlled Phase IV studies.

# STATEMENT OF SIGNIFICANT ACCOMPLISHMENTS (Continued)

## CLINICAL INVESTIGATION DEPARTMENT (Continued)

### Success Rates for Conservative Treatment of Deep Carious Lesions as a Function of an Intermediary Base Material, Base 2

Recall Year	None		Zinc Phosphate		Caulk IRM		All Treatment	
	%†	N	%	N	%	N	%	N
1	85	(81)	50	(6)	86	(7)	83	(94)
2	84	(57)	83	(6)	100	(8)	86	(71)
3	88	(48)	100	(1)	100	(3)	87	(53)
4	90	(20)	100	(2)	100	(2)	92	(24)

†Percent success treatment (total number of teeth).

In Phase III the object of which is to determine the effect of caries constituents on the pulp, test cavity experiments in non-human primate teeth have shown that direct application of control solutions to the pulpal floor of the cavity preparations result in minimal disruption of the underlying odontoblastic layer in the pulp tissue. This is important because it allows changes in pulp tissue of the teeth impregnated with test solutions or caries toxins such as vascular permeability factor (PF) to be associated primarily with reaction to the test solution and of minor reaction to the preparation procedure itself.

Thus far 30 oral organisms from salivary and tooth surface origin have been surveyed for their ability to elaborate PF. Two lactobacilli strains and one streptococcus strain were found to be capable of producing PF. Additionally, 15 strains of lactobacilli were isolated from deep carious lesions. Two lactobacilli strains from caries were found to produce PF. Unfortunately, repetitive growths of these strains in large volumes of media for purification of their PF have resulted in greatly diminished or no PF activity at all. This indicates production of PF by these strains is inducible. Thus, new organism isolates will be obtained from carious dentin samples and such isolate will be initially cultured in a large volume of medium. Cell-free media from growth of isolates which test positive for presence of PF activity in rabbit skin will then be subjected to the PF purification protocol.

The problem of not detecting PF in large volumes of cell-free medium in preparation for purification of PF has hindered obtaining a ready source of PF for use in testing antitoxin agents in primate teeth and tracing the course PF may take through dentin to reach the pulp tissue. The indication of PF being inducible in its production by microorganisms has enabled the investigators to take proper steps as outlined above for purification of PF from bacterial production.

Dilute solutions of stannous fluoride ( $\text{SnF}_2$ ) and molybdenum chloride ( $\text{MoCl}_5$ ) were found to diminish the vascular permeability activity of PF in rabbit skin. Molybdenum usually exists in nature as a positive polyvalent (5+) metal ion.

## STATEMENT OF SIGNIFICANT ACCOMPLISHMENTS (Continued)

### CLINICAL INVESTIGATION DEPARTMENT (Continued)

It is required for certain biological processes such as nitrogen fixation, wherein molecular nitrogen is used to form biologically useful products such as ammonia. Molybdenum may also function as a biologic inhibitor by chelating or binding together metabolically active proteins or other negative ions in a cyclic complex by ionic attraction. Fluoride (F) is a known inhibitor of enzyme activity. Repetitive experiments in rabbit skin showed  $\text{MoCl}_5$  reduced the blueing intensity of the vascular permeability reaction by carries PF up to a five-fold reduction. Experiments with  $\text{SnF}_2$  were not as consistent as with  $\text{MoCl}_5$  since the blueing was reduced in approximately 50% of the injection sites. Both Mo and F will be tested in primate test cavities for their ability to inhibit the PF effect on pulp tissue.

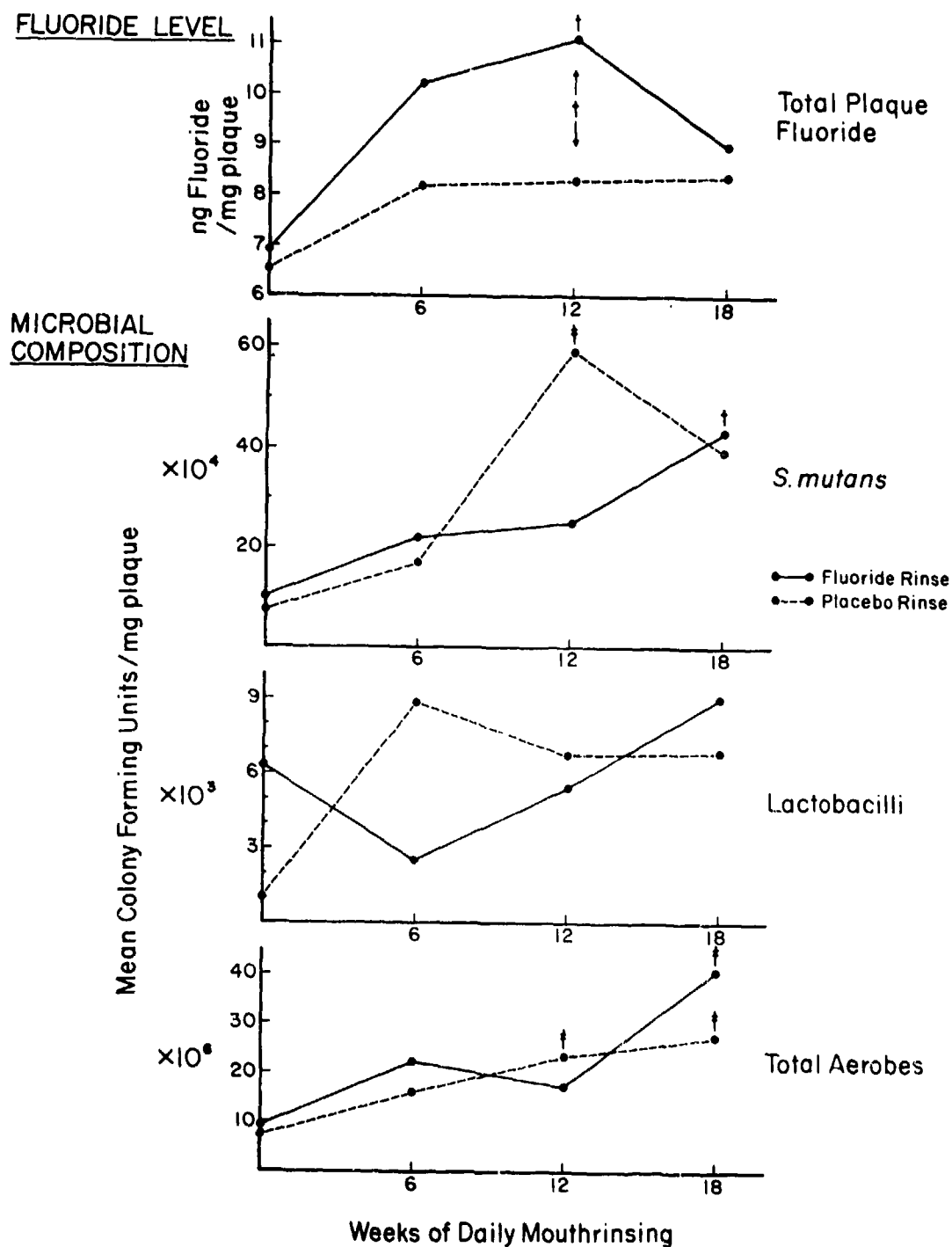
A study was completed in which the anti-carries potential of a 0.05% sodium fluoride (NaF) mouthrinse was evaluated by measuring its effect on fluoride and microbial content of plaque. A population of 186 randomly-selected male naval recruits (mean age  $20 \pm 2.8$  S.D.) rinsed daily for 18 weeks with either the NaF solution or an identical placebo. The baseline level of fluoride was  $6.7 \pm 7.1$  ng/mg plaque (wet weight). Ninety participants used the fluoride rinse and 96 used the placebo rinse. Both rinse groups showed increases in plaque fluoride content at the sixth week of rinsing. The fluoride-rinse group increase was higher than that of the placebo-rinse group, however, this difference was not statistically significant. The control group plaque fluoride content remained at the 6-week level through the remainder of the study. The experimental group plaque fluoride content continued increasing to a peak level at the 12th week of rinsing, which was significantly higher ( $p < .05$ ) than the placebo group level and the baseline level. Upon completion of 18 weeks of rinsing, the experimental group level had decreased such that there was again no significant difference in plaque fluoride content between fluoride-rinse and placebo-rinse groups. No significant differences in microbial counts were shown between groups; however, both groups showed statistically significant increases in *S. mutans* and total aerobes over baseline levels as outlined in the following figure.

High degrees of individual variation in plaque fluoride and microbial content severely limit parametric statistical interpretation. These data suggest that daily rinsing with a 0.05% NaF solution for 18 weeks had no effect on plaque fluoride and microbial content in young adults.

In this study plaque microbial content was reported as colony-forming-units (CFU)/mg plaque. This is a more numerically absolute expression than generally appears in the literature. Microbial content in plaque is usually reported as a relative frequency, such as prevalence (% of total count) or incidence (presence or absence). Mean levels of CFU/mg were used in this study to establish plaque concentration values for total aerobes and cariogenic bacteria in a population of young adult males. The initial number of subjects providing baseline microbial counts was 291. Mean counts were: total aerobes =  $8.70 \pm 25.40 \times 10^6$  CFU/mg, *Streptococcus mutans* =  $9.44 \pm 19.28 \times 10^4$  CFU/mg and *Lactobacillus* =  $2.64 \pm 8.96 \times 10^5$  CFU/mg. The levels of cariogenic bacteria were compared with degrees of caries experience in this population.

STATEMENT OF SIGNIFICANT ACCOMPLISHMENTS (Continued)

CLINICAL INVESTIGATION DEPARTMENT (Continued)



Effect of 0.05% NaF rinse on interproximal total plaque fluoride and microbial composition.

$t=p<0.05$   $f=p<0.01$

## STATEMENT OF SIGNIFICANT ACCOMPLISHMENTS (Continued)

### CLINICAL INVESTIGATION DEPARTMENT (Continued)

Individual caries experience was reflected by the sum of decayed, missing and filled tooth surfaces (DMFS). The mean baseline DMFS was 16.49±9.08. Statistically significant differences were noted in mean cariogenic microbial levels when groups of individuals below and above the overall mean DMFS (16.49) were compared. S. mutans and Lactobacillus mean colony counts were significantly higher in the group with a higher level of caries experience.

#### Interproximal Plaque Bacterial Counts in Male Naval Recruits with High (Mean DMFS=30.5) and Low (Mean DMFS=7.6) Dental Caries Experience

Bacteria	High DMFS (N=113)		Low DMFS (N=178)		P (Welch's t)
	Mean	S.D.	Mean	S.D.	
<u>S. mutans</u> CFUx10 <sup>4</sup> /mg*	12.5	± 20.8	7.4	± 18.4	<0.05
<u>Lactobacilli</u> CFUx10 <sup>3</sup> /mg	4.4	± 11.4	1.6	± 7.0	<0.01

\*Mean colony-forming units per milligram wet weight of plaque sample.

According to our brief review of the literature, the relationship between specific numbers of cariogenic plaque bacteria and degree of dental caries experience has not been previously reported.

Wound healing mechanisms are important to the practice of dentistry. Wound healing most often proceeds in periodontal tissues altered by the chronic inflammatory diseases of gingivitis and periodontitis which are almost universal in precedence. In an experimental application of the development of disease root surfaces, periodontal pockets were prepared about the posterior teeth of four monkeys. The pockets were created by surgical intervention of the periodontal tissue and placement of nylon bands around the roots. These pockets were allowed ten months to develop a chronic periodontitis with horizontal bone loss as seen in naval personnel. The teeth were scaled and polished as typical of pre-surgical preparation in humans. The pocket lining was dissected away and any remaining calculus deposits removed with curette scalers. Two posterior segments in each animal were treated with sodium deoxycholate (NaD) followed by Cohn plasma fraction IV, one segment was treated with phosphate buffered saline (PBS) control, and the fourth segment was unoperated.

The clinical course of healing was that expected for a flap curettage procedure in posterior segments with horizontal bone loss. The gingivae recovered from the edema and there was an occasional loss of tissue at tips of interdental papillae seen at the first postoperative week examination.

## STATEMENT OF SIGNIFICANT ACCOMPLISHMENTS (Continued)

### CLINICAL INVESTIGATION DEPARTMENT (Continued)

During the ten weeks of postoperative care it was not readily apparent which were the experimental or control segments. A few teeth which had slight mobility initially became firm. The roentgenographs presented no significant changes. However, despite the weekly polishing of the crowns of the teeth to remove debris and plaque, a marginal redness persisted. Only in the unoperated control segment of animal subject no. 1 did the redness extend into the attached gingivae and result in bleeding upon probing. This was seen only in the area of the premolars.

The histologic appearance of the unoperated control specimens usually presented calculus on the root surfaces, inflammation in the connective tissues, and a connective tissue attachment level about 0.5 mm coronal to the alveolar crest. The bone loss was generally horizontal, and only a few specimens had a slightly greater loss of attachment on one proximal surface than the other. The operated-control and operated-experimental specimens seemed to have little calculus on the proximal surfaces, but did have an inflammatory reaction in the connective tissue under the crevicular epithelium. The new dentogingival junction was primarily of junctional epithelium, with varying amounts of connective tissue attachment at the apical extent, near the nick in the root surface. All specimens demonstrated some alterations to the cementum surface as a result of the experimental procedures. Small nicks, gouges, splits, and thinned or eroded areas were found in almost every specimen when serial sections were examined. Two operated-experimental specimens presented shallow resorption and repair connective tissue attachments coronal to the nick. In seven of the 48 operated-experimental and in five of the 24 operated-control proximal surface specimens the nick was slightly apical to the crest of the alveolar bone. In one of the operated-control proximal surface specimens the connective tissue attachment was apical to the crest of the alveolar bone. In one of the operated-experimental proximal surface specimens there was a short area of junctional epithelium apical to the connective tissue attachment and coronal to the nick.

In the evaluation of healing at 21 days on the facial surfaces of maxillary incisors the three phosphate buffered saline treated root surfaces all had junctional epithelium to, or apical to, the nick marking the root at the base of the pedicle flap. The six experimentally-treated root surfaces had a mean of 0.40 mm connective tissue new attachment at the apical extent of the wound. This report on proximal surfaces of posterior teeth shows a statistically significant difference in the amount of connective tissue new attachment between experimental and control specimens. While some control specimens did have some connective tissue new attachment coronal to the nick, the overall mean of -0.01 mm indicates that the junctional epithelium generally migrated to the apical extent of the surgery. The combination bile salt and plasma fraction experimental treatment resulted in an overall mean of +0.56 mm connective tissue new attachment. Since only two specimens presented areas of resorption and repair, this healing is thought to be the regeneration of a new attachment.



## STATEMENT OF SIGNIFICANT ACCOMPLISHMENTS (Continued)

### CLINICAL INVESTIGATION DEPARTMENT (Continued)

It was observed during the root surface treatment, that after rubbing each of the four axial root surfaces for one minute each that the roots had a remarkably clean appearance. This could be likened to the operative dentistry principle of "toilet of the cavity". The rubbing of the root surfaces may physically remove minute areas of plaque inadvertently missed with the curettes and remove the dispersed bacteria after instrumentation. The bile salt may improve the cleaning effect by its detergent-like action, by dissociation of endotoxin which could be adsorbed on diseased root surfaces, and by direct antibacterial action. It was concluded from the experiments that the biologic treatment of diseased root surfaces does produce a viable surface for the formation of a new dentogingival junction.

The human plasma fraction Cohn IV<sub>1</sub> was prepared from the pooled plasma of several thousand volunteer donors. Although they were supposedly all tested free of hepatitis virus, we had our Cohn IV<sub>1</sub> lot tested in the Clinical Pathology Laboratory, Naval Regional Medical Center, Great Lakes. It was found to be negative with Abbott Laboratories AUSRIA-125 Radioimmunoassay for detection of Hepatitis B surface antigen.

The detoxification of diseased root surfaces with NaD and Cohn IV<sub>1</sub> produces a viable surface for development of a new dentogingival junction. Thus, it offers an alternative to treatment with harsh chemicals, or the invasive treatment of deep root planing. The presence of some areas of connective tissue new attachment at the apical extent of experimental treated specimens was remarkable, as most histologic studies have found junctional epithelium to the apical level of root instrumentation. It is thought that the connective tissue regeneration proceeds coronally from cells on the cementum side of the periodontal ligament. These cells may be encouraged to migrate further coronally by improving the adhesiveness of the root surface "substrate" by application of fibronectin.

### (Trauma and Surgical Problems Division)

A historical review of the literature has been completed on the subject of laser physics and the biological effects of electromagnetic radiation (EMR). Approximately 2000 references abstracted include discussions on wounds in general and wound healing, the principles of laser radiation physics and other forms of EMR. The subject areas pertain to military and civilian applications of EMR with emphasis on laser energy; ionizing and non-ionizing radiation inclusive of beneficial and harmful effects to biological and non-biological substances; burn wounds, their treatment and healing; and battlefield casualties in past and predicted in future wars. The laser is a useful instrument, effective in manipulating biological substances. It can also be hazardous and its use as a weapon, both anti-materiel and anti-personnel, has been researched for a number of years. The human maxillofacial complex is a highly vulnerable target, particularly in modern warfare.

## STATEMENT OF SIGNIFICANT ACCOMPLISHMENTS (Continued)

### CLINICAL INVESTIGATION DEPARTMENT (Continued)

The findings of this review will be presented as a historical summary of the literature, with concentration on maxillofacial effects in peacetime and war-time environments. The capabilities and limitations as both a healing and an injurious source of energy will be presented for the various configurations of laser systems.

Another study was designed to examine the extraction and retention of third molars among naval personnel as a function of their initial status upon entry into the Navy and of subsequent treatment received. Dental records of 300 randomly selected staff personnel stationed at the Great Lakes Naval Base were examined. Mean age of the sample at time of entry into the Navy was 19.6 years. There were 1072 third molars present and 646 of these were unerupted. Both crown encapsulation and clinical angulation were determined for unerupted third molars. For maxillary molars, 91.1% were vertically or distoangularly inclined and 79.6% of mandibular third molars were vertically or mesioangularly inclined. During the period under study 185 third molars erupted. The most common reason given for extracting mandibular third molars was "Malposition" and for maxillary third molars was "No Opposing Tooth". Mean age of extraction was 23.4 years. Third molar extraction was directly related to whether a tooth had erupted. Each quadrant was evaluated separately and third molars were placed into one of three categories; unerupted, erupted after entry, or erupted at entry. Using a 2x3 chi square, the differences were statistically significant for all four quadrants at the  $p < 0.02$  level. Third molars were less likely to have been extracted if they were erupted initially or erupted during the study. Extraction was not related to crown encapsulation or angulation. The overall rate of extraction decreased with age while the reason for extraction was more likely to be related to symptomatic conditions as age increased.

#### (Dental Care Delivery Division)

Since October 1979 a total of 516 recruit subjects and 189 non-recruit subjects have been examined. Saliva samples were obtained from both recruit and non-recruit subjects, to determine if the counts of Colony Forming Units (CFU) in the saliva at an initial examination of both Streptococcus mutans and lactobacillus could be used in conjunction with dental disease indices to predict those most at risk for increased dental caries during subsequent time periods.

The following table presents the incidence of dental caries related to initial saliva counts of S. mutans and lactobacillus for the recruit sample. For the recruits who were available for six-monthly examinations, there were no differences in the initial CFU counts for S. mutans or lactobacillus for 81 subjects grouped by the number of tooth surfaces lost to decay during the six-month observation period. The bias of the sample was high, however, due to the inability of NDRI to re-examine more than about 10 percent of the initial sample. In addition, with longer term data (1, 2, 3 year), the use of initial saliva counts of cariogenic bacteria might prove to be useful in the identification of recruits most at risk for dental caries during their first enlistment. The valid use of the SF-603, dental record, could provide such longitudinal data.

# STATEMENT OF SIGNIFICANT ACCOMPLISHMENTS (Continued)

## CLINICAL INVESTIGATION DEPARTMENT (Continued)

Relation Between S. mutans Counts in the Saliva and Sound Tooth  
Surface Decrement in Six Months for Naval Recruits,  
Great Lakes, IL 1979-81

Decrement of Sound Tooth Surfaces in Six Months		Mean Microbiologic Counts (x10 <sup>3</sup> CFU/ml of Saliva)	
		<u>S. mutans</u> *	Lactobacillus*
None	Zero (N=29)	79.91	1.99
Middle	1-3 (N=30)	84.95	9.69
High	4-12 (N=22)	73.69	6.78

\*No statistically significant differences observed using one-way ANOVA.

The prevalence of dental disease for the recruit population is depicted in the table below. There were few differences between the randomly and the service school selected groups. Only age and the Screen Score (success chances in the Navy for recruits entering the Navy) showed statistical differences. Since the selection for service school was based on the Screen Score, our data are consistent with recruiting standards (e.g., those with higher Screen Scores are preselected for service school after RTC training). There were no differences in the counts of S. mutans and lactobacillus in saliva, which means that the prevalence of dental caries in our sample could be predicted using salivary microbiological counts as a predictor.

Relationship of Service School Selected and Randomly Selected  
Recruits to Dental Indices. Great Lakes, IL 1979-81

Dental Indices	Service School Selected (N=342) Mean	Randomly Selected (N=174) Mean	Statistical Significance
#BLES	2.81	2.97	NS
#CLES	0.50	0.46	NS
#ULES	0.59	0.44	NS
<u>S. mutans</u> x10 <sup>3</sup> CFU/ml saliva	187.54	94.78	NS
Lactobacillus x10 <sup>3</sup> CFU/ml saliva	12.79	6.4	NS
Screen Score	85.71	82.15	p<0.05
Age	19.70	18.97	p<0.05
NPDI Total	19.19	20.21	NS
Time needed to complete periodontal therapy (minutes) per 100 recruits	7980	8970	Treatment time needed by randoms = 1.12x that of selects

\*Welch's t-test.

## STATEMENT OF SIGNIFICANT ACCOMPLISHMENTS (Continued)

### CLINICAL INVESTIGATION DEPARTMENT (Continued)

Cursory analyses of the differences in dental disease prevalence since 1975 for recruits at RTC, Great Lakes, are presented in the table below. There were no age differences among recruits for the time periods 1975-78 and 1979-81. The periodontal disease indices were not different. The caries indices, however, did show differences. Recruits who entered the Navy in 1975-78 had statistically higher caries history indices (i.e., DT, FT, DMFT, DS, DMFS), except for missing teeth, than recruits who entered during 1979-81. This could reflect a change in recruitment from mostly rural areas to more urban areas where fluoridation of public water supplies has its greatest effect.

Comparison of Mean Values of Caries and Periodontal Indices for Naval Recruits During Two Different Time Periods. Great Lakes, IL.

	1975-78 (N=1180)	1979-81 (N=516)	Statistical Significance*
DT	6.08	3.82	$p \leq .05$
MT	0.52	0.63	NS
FT	6.14	4.41	$p \leq .05$
DMFT	10.74	8.85	$p \leq .05$
NPDI Total	18.95	19.53	NS
Age	19.03	19.45	NS

\*Welch's t-test.

One could speculate that a portion of the differences in the prevalence of decayed teeth (DT) from 1975 to 1981 was due to a change of examiners which occurred in 1978. In 1978, however, a calibration exercise indicated that the reliability between examiners for DMFT was 85 percent (i.e., 85 percent of the calls made for DMFT were identical). Since 1978, only one examiner has conducted the caries examination. The data relating to intra-examiner variability since 1978 are presently undergoing analysis.

In 1966-70, among the civilian population, the mean DT for 17-year-old males was 2.0; in 1971-74 the reported mean DT for randomly selected 12-17 year-old males was 1.9. (National Center for Health Statistics, U.S. Public Health Service, publication series 11, numbers 144 and 214). If one compares these latest available data from the civilian population to the data from our recruit study, it is apparent that, on the average, recruits entered the naval service at Great Lakes with twice (DT=3.82) the number of decayed teeth compared to civilians (DT=1.9). While statistical comparisons are not appropriate for these data, the sheer magnitude of the difference between civilians and naval recruits in the prevalence of decayed teeth could have important implications for the Navy Dental Corps.

Navy dental officers are confronted with an enormous backlog of dental treatment needs for recruits due to caries. Even though the absolute prevalence decreased in recent years (from DT=6.08 to DT=3.82), the relative

## STATEMENT OF SIGNIFICANT ACCOMPLISHMENTS (Continued)

### CLINICAL INVESTIGATION DEPARTMENT (Continued)

differences with the civilian population did not change dramatically (from three times to two times the rate of decay for recruits compared to civilians). Obviously, the average naval recruit had double the treatment needs due to dental decay as did civilians. At the same time there was a tremendous need for periodontal therapy among recruits in terms of time needed to complete periodontal therapy (see the table below).

The data below depict the comparison of the recruit sample with a sample of older naval personnel. Recruits in general had higher number of decayed teeth (DT) compared to staff personnel, whereas, the overall caries history indicator (DMFT) for the staff personnel was increased. The salivary counts of *S. mutans* and lactobacillus were not different between the two groups, which means, at least for these samples, that salivary microbiological counts were not useful in distinguishing recruits from older naval personnel with samples of saliva. More detailed, multivariate analyses, however, are indicated using dental decay incidence as the dependent variable. Oral hygiene differences (i.e., NPI total) were noted, but these differences were not reflected in the overall periodontal disease prevalence (i.e., NPDI total) nor in the amount of time needed to complete periodontal treatment for recruits and staff personnel (based on the distribution of Periodontal Case Types). Periodontal Case Types were derived from consensus agreement of NRDC, Great Lakes, periodontists. The highest NPDI score and Calculus Surface Total (CSI) were used to categorize individuals (into six Periodontal Case Types) as to treatment needs using the Dental Information Retrieval System (DIRS) values for treatment times.

Comparison of Staff Personnel and Recruit Subjects with Respect to  
Dental Disease Indices. Great Lakes, IL 1979-81

	Recruits (N=516) Mean	Staff (N=189) Mean	Statistical Significance*
DT	3.82	0.89	p<.001
MT	0.63	1.66	p<.001
FT	4.41	9.83	p<.001
DMFT	8.85	12.39	p<.001
#BLES	2.86	0.88	p<.001
#CLES	0.49	0.08	p<.001
#ULES	0.54	0.14	p<.001
<i>S. mutans</i> counts x10 <sup>3</sup> CFU/ml of saliva	156.68	198.51	NS
Lactobacillus counts x10 <sup>3</sup> CFU/ml of saliva	10.65	43.54	NS
Age	19.45	29.21	p<.001
NPDI Total	19.53	19.16	NS
Time needed to complete periodontal therapy (minutes) per 100 persons	9530	10680	Treatment time needed by staff subjects = 1.12x that of recruits

\*Welch's t-test

## STATEMENT OF SIGNIFICANT ACCOMPLISHMENTS (Continued)

### CLINICAL INVESTIGATION DEPARTMENT (Continued)

The Navy Dental Corps could devote its resources full-time to the problem of dental decay in recruits, for its nonrecruit staff personnel were equally in need of dental treatment as outlined in the preceding table -- particularly treatment for chronic inflammatory periodontal disease. Staff people also had an increased need for the replacement of missing teeth (MT) and to correct the incidence of dental decay (DT) which continued after recruit training. From cursory examination of dental records it would appear that dental treatment time was largely devoted to repairing enamel and dentin defects due to decay, and less time was devoted to periodontal therapy. Our data indicate that need for periodontal therapy was an important part of the total treatment needs of naval and Marine Corps personnel. Combat readiness cannot be assured for the operational forces if the periodontal diseases are not controlled. Innovative, conservative, and preventive periodontal therapies are being discussed in the open literature and should be evaluated in naval personnel to attempt to control the problem of periodontal diseases in the naval service population.

An attempt was made to determine if the sample of staff personnel who responded to the dental recall system (which NDRI used in selecting volunteers for examination) was biased. Dental records were abstracted and related to status of response (i.e., examined; did not keep examination appointment). Significant relationships included: (1) nonresponders were less likely than responders to have completed all required treatment at the conclusion of their last appointment; (2) nonresponders had fewer preventive appointments per year than responders; (3) nonresponders were less likely than responders to have a dental record on file at NRDC, Great Lakes; and (4) nonresponders were less likely than responders to have their original dental record on file at NRDC, Great Lakes. It was concluded that nonresponse was inversely related to variables, derived from the dental record, associated with good dental care (e.g., preventive appointments, treatment received at previous appointments, etc.). It can be inferred, then, that our responders (those who kept recall appointments and were examined) were statistically different from the non-responders. This may indicate that the prevalence of dental disease derived only from examinations of responders underestimates the prevalence of dental disease in a sample of naval personnel. Follow-up reminders through the Commanding Officer, NRDC, Great Lakes, are now being sent to nonresponders to try to decrease the bias in the estimate of dental disease. Operationally, these data indicate that dental recall systems should concentrate their efforts in recalling those at risk for dental disease or dental emergencies (i.e., those whose treatment has not been completed, no record is available, few preventive appointments) instead of recalling everyone each year. Concentration of effort could lead to a more combat ready naval force from the perspective of being relatively free of dental disease and without the expectation of having dental problems occur during combat missions.

During FY 1981, a system of optical scan computer entry cards was designed. These cards allow the input of epidemiologic examination data directly to a data base without being transcribed or coded by clerical personnel. This system could be used by research teams as well as forensic dentists to cross-check dental disease patterns and treatment patterns. These kinds of data can

## STATEMENT OF SIGNIFICANT ACCOMPLISHMENTS (Continued)

### CLINICAL INVESTIGATION DEPARTMENT (Continued)

be stored and retrieved in digital format and then visually reproduced using a plotter. The refinement of this system will continue in FY82 with more indices being added (i.e., periodontal indices, treatment needed indices). With only five optical scan cards, an individual's health status will be able to be computerized for analysis, storage, easy retrieval and for cross-indexing with the use of minimal clerical assistance. This system will also allow for the easy and standardized collection of data from areas remote to Great Lakes with immediate computer input.

An investigation was initiated to evaluate the relationship of personnel performance to caries predictive factors. In this study an attempt was made to relate independent dental indices (i.e., diseased teeth, DT, missing teeth, MT, etc.) to dependent demographic variables like the Armed Forces Qualification test scores. A positive relationship between one or more of these variables would serve as a means of predicting whether or not a recruit would graduate from recruit training camp and/or complete his first year of naval service.

The collection of demographic and epidemiologic data relating dental caries and personnel performance was concluded for 794 male naval recruits. While there were some statistically significant ( $p < .05$ ) relationships between dependent and independent variables, the development of a suitable predictive model has not been possible. Of 794 individuals, 104 (13.2%) failed to graduate from recruit training. However, only 3% of all the operative and oral surgery procedures completed on the 794 individuals were accomplished on those recruits who failed to graduate. Data collection for those individuals concluding their first year of naval service is not yet completed.

An 8'x 8'x 20' collapsible controlled-environment container for a modular shelter system, which meets international shipping standards, underwent evaluation as a dental treatment facility at NDRI.

The ADEC Porta-Chair, fiberoptic light, and the main components from the ADEC Porta-Cart were assembled into an over-the-patient dental delivery system to reduce the weight/cube of the ADAL and to gain needed working space inside.

A complete field X-ray system was designed and evaluated. It consisted of a water-proof, high impact resistant plastic box with recessed snaps and handles. The box contained layers of form-cut protective foam, an X-ray developer, developer chemicals, water, lead X-ray apron, X-ray tube head, controls, adjustable stable tripod stand, and film. The system is entirely self-contained and could support a dental operational field unit for at least 30 days.

A prepackaged, dental treatment tray system was also developed and evaluated for use in the field. Currently we are working with a color coded dual tray concept with each color representing a particular dental treatment procedure. With this system one tray will be set up for an operator and

## STATEMENT OF SIGNIFICANT ACCOMPLISHMENTS (Continued)

### CLINICAL INVESTIGATION DEPARTMENT (Continued)

one tray will be set up for the technician, containing all the needed supplies for that procedure. The goal is to prevent contamination and waste and define supply needs for 30 days. The present standard stock sterilizer could accommodate both trays at once.

The features of three dental radiological techniques were compared through an exhaustive review of the literature: extraoral source and intraoral film placement; panoramic extraoral source and extraoral film placement; and intraoral source with extraoral film placement. Some of the interesting characteristics of the different technics concern the differences in radiation levels to which a dental patient might be exposed.

The radiation dose experienced by the dental patient, on whom a conventional full-mouth set of periapical diagnostic radiographs is exposed, may be as much as fifty times the levels of radiation necessary for radiography taken with the source placed within the mouth. A conventional panoramic radiograph exposes the patient to six times the radiation absorbed when an intraoral X-ray source is used. Rod anode equipment, consisting of a radiation source at the end of a narrow cylindrical tube, permits an intraoral positioning of the X-ray source.

Although existing X-ray techniques have some clinical advantages, concern over levels of exposure to radiation with conventional dental radiography has spurred the development of rod anode technology for dental diagnosis. Tomography, which permits the development of an image which does not portray the extraneous bony structures of the head, offers a low resolution with high distortion. For diagnostic reasons, the standard series of sixteen periapical radiographs is preferred for clinical diagnoses, albeit producing higher levels of radiation exposure. Panoramic radiographs taken with an intraoral source provides considerably more diagnostic information than conventional panoramics, with far less exposure than either panoramic tomography or periapical radiography. Since it is difficult to recognize incipient caries or periodontal pathology from rod anode panoramics, a combination of techniques (i.e., rod anode panoramics with bitewing or periapical radiographs of restricted regions) might provide complete information at reduced radiation risk.

A number of minifocus, high-resolution rod anode tubes have been developed in recent years. The Westinghouse Panoramix, the Siemens Status X2, and the Comet Dentix have been the most important, commercially marketed systems using these new tubes. The Dentix appears to be the most versatile of these devices because it can operate in both conventional and intraoral source modes.

The use of the rod anode in its present state of development means compromise. It would significantly lower the exposure dose of a patient receiving a radiologic work-up. The tradeoff, unfortunately, is in a reduction of diagnostic clarity so that adjunctive bitewing or selective periapical radiographs may be necessary -- a common practice in recruit in-processing clinics.



## STATEMENT OF SIGNIFICANT ACCOMPLISHMENTS (Continued)

### CLINICAL INVESTIGATION DEPARTMENT (Continued)

The available literature on the medical and dental applications of xeroradiographic techniques indicate advantages over conventional radiological methods. Of most direct concern to the patient is the significantly decreased X-ray exposure necessary in the xeroradiographic imaging process. Also, diagnostic advantages of the process are numerous, with the chief advantage being the enhanced imaging of the gingiva due to the increased contrast by the electrostatic edge effects of the imaging system. Many studies have substantiated the diagnostic usefulness of this property.

In addition to these clinical advantages, the xeroradiographic system has many points of convenience in its favor. The Xerox 110 intraoral dental xeroradiography system uses reusable cassettes at great savings in film costs and processing to produce photographs ready for viewing within twenty seconds, without need for a darkroom.

Projected savings were calculated to be \$23,000 for maintenance and labor per 20,000 processed films. Additionally, the use of single 110 xeroradiography developer could possibly equal the work load of nine S. S. White AUVELOPERS. From the costs and data obtained in this preliminary report, the Xerox 110 device appears to be beneficial from both a clinical and financial aspect and it would be feasible to conduct further studies for use in military dental clinics.

A project has begun to evaluate commercially available face shields for application with Navy and Marine Corps combat dress. A suitable face shield would be one that is compatible with current helmet and gas mask systems, and that would have the ability to deflect artillery/grenade fragments, attenuate high velocity small arms rounds and be heat resistant. To date, five models of commonly used police and military face shields have been procured and sent to a Department of Defense Ballistics contractor for analysis of fragmentation stopping ability.

## STATEMENT OF SIGNIFICANT ACCOMPLISHMENTS (Continued)

### SCIENTIFIC DEPARTMENT

(Microbiology Division)

Streptococcus mutans produces water-soluble and insoluble glucans when grown in the presence of sucrose. The enzyme, glucosyltransferase (GTF), normally found in S. mutans is responsible for the synthesis of the glucans. The glucans, particularly the insoluble glucans, promote the development of dental plaque and have been implicated as a virulence factor in the development of dental decay.

A number of compounds were tested for their ability to interfere with glucosyltransferase synthesis of insoluble glucans. It was previously found that sodium lauryl sulfate (SLS) and cetylpyridinium chloride (CPC) at low concentrations (0.005 percent) inhibited at least 80 percent of enzyme activity. This past year four additional compounds, monolaurin, benzethonium chloride (BC), cetylpyridinium bromide (CBC) and methyl benzethonium chloride (MBC), were tested for their ability to inhibit GTF activity.

Monolaurin, a fatty acid which has been reported to reduce smooth surface caries in rats, produced inconsistent GTF inhibition results. The compound at concentrations of 0.5 and 0.05 percent stimulated the production of both soluble and insoluble glucans when tested with S. mutans, K-1R derived GTF, whereas monolaurin caused a decrease in glucan synthesis when GTF from S. mutans strain 10449 was used. The lower concentration of monolaurin, 0.05 percent, was also much more effective than the 0.5 percent concentration in inhibiting the glucans synthesized from the #10449 derived GTF. The reason for these discrepancies is not known.

The other compounds tested, BC, CPC, and MBC inhibited at least 85 percent of GTF activity at a concentration of 0.01 percent. At a concentration of 0.002 percent, BC inhibited all GTF activity.

The compounds SLS, BC, and CPC at concentrations of 0.05 percent were swabbed on hamsters teeth infected with S. mutans. Only the BC at this concentration significantly inhibited caries in these animals. The surfactants, CPB and MBC will also be tested in the hamster caries model system. Compounds that are effective GTF inhibitors at low concentrations, non-toxic, and can significantly reduce caries in the animal model system should be tested in human volunteers. The concentration and methods of dispensing a test compound in humans has not, as yet, been determined. However, such a compound properly dispensed could be useful in controlling dental plaque formation and reduce the caries incidence in a military population.

Many studies indicate that specific oral streptococci synthesize an adhesive polysaccharide, rich in  $\alpha$ -1, 3-glucosidic linkages. This glucan facilitates the adherence of cariogenic bacteria to the tooth surfaces as part of a specific dental plaque responsible for dental caries. We have studied enzymatic methods of dissolving these water-insoluble glucans as a method of controlling dental caries. An enzyme,  $\alpha$ -1, 3-glucanase, isolated from Pseudomonas sp. NRRL-13-12324 was found to dissolve the  $\alpha$ -1, 3-glucan in vitro. This enzyme was tested and evaluated for its ability to prevent dental caries in male

## STATEMENT OF SIGNIFICANT ACCOMPLISHMENTS (Continued)

### SCIENTIFIC DEPARTMENT (Continued)

Syrian hamsters. The animals given the enzyme on a continuous basis, in their drinking water, had significantly lower ( $p < 0.05$ ) total caries and caries area scores than the unprotected positive control group.

The enzyme was also studied *in vitro* for its ability to prevent the sucrose-dependent accumulation of  $^3\text{H}$ -thymidine-labelled *S. mutans* cells on hydroxyapatite disks. The enzyme was shown to significantly ( $p < 0.05$ ) reduce the accumulation of cariogenic streptococci relative to untreated controls. It was concluded that the enzyme interfered with the adherence and/or accumulation processes of the cariogenic bacteria upon the artificial tooth surfaces. This would explain the ability of the enzyme to prevent or reduce dental caries in experimental animals.

Studies involving the biochemical characterization of the  $\alpha$ -1, 3-glucanase were completed. The enzyme was shown to have an isoelectric point of 4.6 ( $4.55 \pm 0.13$ , mean of five determinations). Two activity peaks could be resolved by column gel-filtration chromatography using either Bio Gel A-15M or Ultrogel ACA-34.

We have previously reported on studies of a fungal dextranase isolated from *Fusarium moniliforme* which acted as a caries preventive agent. This enzyme (FD) was shown to have a very high affinity for hydroxyapatite, the principal mineral component of human tooth enamel. During FY81 the isoelectric point of FD was determined to be near pH 7.0. The isoelectric point determinations were an important preliminary step in determining procedures for developing a chemical linkage of the FD with the  $\alpha$ -1, 3-glucanase. The resulting adherent compound could represent an improved caries preventive agent. Such an agent will be tested in a human clinical trial when demonstrated to be safe and effective in animal experiments.

Microorganisms play a significant role in the development and progression of periodontal disease. The control of the periodontopathic organisms with the use of non-antibiotic medicaments is very appealing. The risks of antibiotic therapy are avoided and it may prove possible for the patient to apply medicaments himself, thus reducing time in the dentist's chair. The use of detergents could facilitate the removal of plaque and bacteria from periodontal pockets. Such compounds would be of particular value if they also exhibited antibacterial properties.

Initially six surfactants, benzalkonium chloride (BZC), cetylpyridinium chloride (CPC), sodium lauryl sulfate (SLS), Teepol 610, Tween 60 and 80, were tested for their inhibitory effects against four species of periodontopathic bacteria: *Bacteroides melaninogenicus* ss *intermedius*, *Bacteroides ochraceus*, *Fusobacterium nucleatum* and *Treponema oralis*. *B. melaninogenicus* and *B. ochraceus* were inhibited by 6.25 to 12.5  $\mu\text{g/ml}$  of BZC or CPC, and by 25  $\mu\text{g/ml}$  of SLS. *F. nucleatum* was inhibited by 25  $\mu\text{g/ml}$  of BZC or SLS and by 50  $\mu\text{g/ml}$  of CPC. The bactericidal level of BZC, CPC, and SLS was 5.0  $\mu\text{g/ml}$  for *T. oralis*. Teepol 610 was bactericidal for *T. oralis* at 15  $\mu\text{g/ml}$ , but failed to inhibit the other species tested at concentrations up to 100  $\mu\text{g/ml}$ . Neither Tween 60 or 80 were inhibitory for any of the organisms tested at concentrations of 100  $\mu\text{g/ml}$ .

# STATEMENT OF SIGNIFICANT ACCOMPLISHMENTS (Continued)

## SCIENTIFIC DEPARTMENT (Continued)

Because of their inhibitory properties at low concentrations for the periodontopathic organisms tested, BZC and SLS were evaluated in the rice rat, Oryzomys palustris, for their ability to reduce or prevent periodontal disease. The mean alveolar bone loss in the rice rats inoculated with the test organisms and treated with the surface active agents is shown in the table below.

Mean Alveolar Bone Loss in Rice Rats Inoculated with Oral Anaerobic Bacteria and Treated with Surface Active Agents

Treatment	<u>Bacteroides</u> <u>melaninogenicus</u> <u>ss intermedius</u>		<u>Bacteroides</u> <u>ochraceus</u>		<u>Fusobacterium</u> <u>nucleatum</u>		No Organism	
	Male	Female	Male	Female	Male	Female	Male	Female
BZC	13.8	10	11.6	8.2	14.2	12.8	14	11.6
SLS	11	11	9.2	8.6	14	12.2	11	10.2
H <sub>2</sub> O	12.2	11.2	11.4	13	12	11.4	11.2	13.8
None	14.2	11.6	13.2	10	15	12.6	14.4	10.8

The animals inoculated with F. nucleatum had the greatest bone loss followed by B. melaninogenicus and B. ochraceus. Bone loss was significantly greater in male rats; this may be due to their layer size when compared to females. Pair-wise ANOVAs (4x2x2) analysis indicated that SLS was superior to other treatments ( $p < 0.01$ ), whereas the other groups did not differ significantly between one another.

The above experiment demonstrated that SLS was effective in controlling the periodontopathic bacteria and bone loss in the rice rat. Modes of application and concentrations effective in human subjects remain to be investigated.

(Biochemistry Division)

Oral bacteria metabolize certain basic salivary peptides, such as the tetrapeptide "sialin", to organic bases which can produce a salivary pH-rise response, and thus may possibly function as protective agents against dental caries. The pH-rise response can be produced by parotid saliva as well as the whole saliva supernatant fraction. Previously we have observed that caries-free subjects tend to show higher mean whole saliva pH-rise profiles, with higher pH minima, than caries-active subjects. The differences in mean profiles were attributed to effects both from the salivary sediments and the salivary supernatants for the two types of subjects. During FY81 we have attempted to determine whether the supernatant factors causing the differences in the

## STATEMENT OF SIGNIFICANT ACCOMPLISHMENTS (Continued)

### SCIENTIFIC DEPARTMENT (Continued)

caries-free/carries-active pH-rise profiles could be ascribed, at least in part, to sialin or other basic salivary peptides.

Although earlier work has shown no differences in free peptide levels in caries-free and caries-active parotid saliva samples, as determined fluorimetrically, we had no data on levels of the salivary proteins from which the peptides could be produced. Accordingly, samples of parotid saliva from 46 caries-free and 47 caries-active recruits were analyzed electrophoretically, under a collaborative arrangement with an investigator for the University of Washington. Although individuals within each group showed wide variations in protein distributions, no significant differences could be determined in basic protein distributions. Concomitant information was obtained on the parotid saliva samples from 25 of the caries-free and 25 of the caries-active subjects. The basic proteins were separated from the samples by ion-exchange chromatography on mini-columns, and levels of basic and total proteins were determined. None of the intergroup differences in mean values for flow rates, basic proteins, or total proteins were statistically significant.

The influence of salivary buffering factors on the caries-free/carries-active pH-rise profile differences was then explored. Whole saliva supernatants from 28 caries-free and 28 caries-active recruits were assayed for bicarbonate, inorganic phosphate, and total protein content. Profiles on pH rise were also acquired, using Lactobacillus casei cells instead of salivary sediments. Statistical analysis revealed a strong positive correlation of pH minimum and bicarbonate concentration for the samples (caries-free:  $r=0.727$ ,  $p<0.01$ ; caries-active:  $r=0.485$ ,  $p<0.01$ ), but no correlation was evident between pH minimum and inorganic phosphate or total protein content.

It was concluded from these studies that the differences in salivary supernatant responses depended in part, if not entirely, on bicarbonate buffering effects. No evidence could be adduced, insofar as measurements were practicable, to indicate that there were differences in sialin or basic peptide content of saliva samples, or in protein levels potentially giving rise to these peptides, from the two groups of subjects.

An investigation of the salivary antibacterial factor, hypothiocyanite, has been initiated. Whole saliva samples have been collected from approximately 30 caries-free and 30 caries-active recruits and analyzed for hypothiocyanite, thiocyanate, and lactoperoxidase activity. Evaluation of the data is in progress.

### (Histopathology Division)

Treatment procedures need to be developed that will restore the attachment of soft tissue to contaminated tooth surfaces following trauma or surgery. Cell culture experiments were conducted comparing cell attachment of human fibroblasts to surfaces made toxic by oral bacterial endotoxin and to toxic surfaces pretreated with various biochemicals to detoxify it or improve cell

## STATEMENT OF SIGNIFICANT ACCOMPLISHMENTS (Continued)

### SCIENTIFIC DEPARTMENT (Continued)

attachment. Normal human fibroblasts were inhibited from attaching to a culture surface that was coated with bacterial endotoxin (LPS) isolated from oral strains of Bacteroides or Fusobacterium, which are Gram-negative anaerobes. The LPS from Fusobacterium inhibited cell attachment to a greater degree ( $p < 0.001$ ) than that<sub>2</sub> of the LPS from Bacteroides, and at a concentration as low as 12.5 ng/cm<sup>2</sup> ( $p < 0.001$ ). When LPS-coated culture dishes (12.5 ng/cm<sup>2</sup>) were incubated with a concentration of plasma fibronectin (a circulatory blood glycoprotein) as low as 50 µg/ml for at least 15 minutes, the fibronectin significantly enhanced cell attachment returning it to control levels ( $p < 0.001$ ). Furthermore, when plasma fibronectin (50 µg/ml) was compared to other agents such as bile acids, citrated serum and human plasma fraction IV<sub>1</sub> (Cohn), which have been shown to affect the toxicity of LPS, fibronectin led to significantly more cell attachment in the presence of LPS than any other treatment ( $p < 0.001$ ). Evidence is presented by means of transmission electron microscopy (TEM) that LPS may bind to fibronectin. Subsequently, the cell surface interacts with the fibronectin-LPS and internalizes it via phagocytosis. This mechanism provides for the clearance of LPS from the culture surface. This study may have application to the management of maxillofacial war injuries involving the healing of gingival tissue to the teeth.

## STATEMENT OF SIGNIFICANT ACCOMPLISHMENTS (Continued)

### ADMINISTRATIVE DEPARTMENT

Energy management has continued to receive notable attention and support during the year. A special project for improvements to the animal colony facility is near completion and a certification inspection was conducted with results pending. The "personnel services" support agreement with the Personnel Support Detachment, Naval Regional Medical Center, Great Lakes is operating at maximum efficiency and has been a welcomed asset to the NDRI Administrative Department.

The Administrative Department continued an effective supporting role during the FY81 project year. The department continues increased efficiency and support of investigators conducting dental and oral health research through a comprehensive job order and cost accounting plan and through improved local accounting structure.

The Photographic and Graphic Arts Branch has continued a vital support role for investigator-project accomplishments. During the year more than 340 original graphs and charts, 3200 negatives, 4300 prints, and 6000 positive slides (diazos) were produced. Optimal goal oriented results reflect the outstanding performance characterized the audio visual support team.

During the year all supervisors completed the new civilian Basic Performance Appraisal training program. The Naval Dental Research Institute hosted the Dental Officer Casualty Care Treatment training program administered by the Naval Regional Dental Center. Two members completed the Navy Commercial Industrial Type Activities training program. One Petty Officer completed his masters degree in health care administration. Several members completed varied training through courses of instruction, seminars, and off-duty education which has enhanced accomplishments of the activity's mission.

HONORS, AWARDS, POSITIONS HELD, CEREMONIES, STAFF ARRIVALS,  
DEPARTURES AND REENLISTMENTS

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OCTOBER

Captain M. R. WIRTHLIN was inducted as a Fellow, International College of Dentists, New Orleans, Louisiana.

The Sea Service Deployment Award was received by:

DT1 M. L. MINTEN

DT3 T. P. McCARTHY

DT3 D. PORTIS

DN D. H. GAGNON

DN D. H. GAGNON received the Battle E award.

CDR R. W. GAUGLER detached for duty at the Uniformed Services of the Health Sciences, National Naval Medical Center, Bethesda, MD.

LT J. C. MEIERS detached for DUINS at the University of Minnesota, Minneapolis, Minnesota.

DT3 M. P. GOLDING reported for duty from the Clinical Laboratory School, Ft. Sam Houston, Texas.

DT3 S. M. PATTON reported for duty from the Clinical Laboratory School, Ft. Sam Houston, Texas.

DA W. L. STROUD reported for duty from the School of Dental Assisting and Technology, San Diego, California.

NOVEMBER

CDR R. G. WALTER was awarded the Sea Service Ribbon for duty with 3 FSSG, Okinawa, Japan.

TSGT A. J. HORTON received the GLEEM Yard of the Month award.

DT2 R. A. NORTHERNER detached for duty at the 3rd Force Service Group, FMF PAC, Okinawa.

JANUARY

CAPT J. M. ANDERSON retired from active duty after 22 years of service.

DT2 G. L. BAILEY was frocked to E-6.

HM2 D. A. TRIHER received a Good Conduct Award.

DT2 S. HOEFS received the Navy-Marine Corps Medal.

DT1 G. L. BAILEY received the Navy-Marine Corps Medal.

DT2 S. M. PATTON was frocked to E-5.



HONORS, AWARDS, POSITIONS HELD, CEREMONIES, STAFF ARRIVALS, DEPARTURES,  
AND REENLISTMENTS (Continued)

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JANUARY (Continued)

Mrs. N. I. HUERTAS joined the staff in the Veterinary Sciences Division.

Mrs. C. R. ROSS resigned from the Veterinary Sciences Division.



RADM C. E. GURNEY III, Commander Naval Training Center, Great Lakes  
presenting DT2 S. R. HOEFS with the Navy-Marine Corps Medal.

FEBRUARY

Mrs. M. C. CHANDLER joined the staff of the Microbiology Division.

MARCH

Ms. S. Y. WINN joined the Office Services Branch, Operating Services  
Division.

APRIL

Dr. M. E. COHEN was promoted to GS-11 Statistician (Health and Medicine).

LCDR F. AKER received a Master of Arts degree in Hospital Administration  
from Webster College, St. Louis, Missouri.

HONORS, AWARDS, POSITIONS HELD, CEREMONIES, STAFF ARRIVALS, DEPARTURES,  
AND REENLISTMENTS (Continued)

APRIL (Continued)

CDR J. C. CECIL was appointed as a member to the Subcommittee on Preventive Periodontics of the American Association of Public Health Dentists.

Dr. L. G. SIMONSON received an Outstanding Performance Award.

DT1 W. V. REESE was nominated NDRI's "Sailor of the Year."

DT1 J. M. McCORMICK reenlisted for a period of six years.

DA D. E. THOMAS reported for duty from the School of Dental Assisting and Technology, San Diego, California.

MAY

LCDR L. D. NELSON received the Navy Achievement Medal.

Dr. L. G. SIMONSON received a Sustained Superior Performance Award.

DT1 W. V. REESE received the Navy Achievement Medal.

DT3 T. P. MCCARTHY was advanced to E-5.



RADM C. E. GURNEY III, Commander Naval Training Center, Great Lakes  
presenting DT1 G. L. BAILEY with the Navy-Marine Corps Medal.

HONORS, AWARDS, POSITIONS HELD, CEREMONIES, STAFF ARRIVALS, DEPARTURES,  
AND REENLISTMENTS (Continued)

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MAY (Continued)

DA D. E. THOMAS was advanced to E-3.

LCDR E. J. MUELLER detached for duty at the Naval Health Research Center, San Diego, California.

DTC P. M. WAGNER retired from active duty.

JUNE

Ms. M. J. ROUSE received a Sustained Superior Performance Award.

Ms. J. J. RAMIREZ received a Quality Step Increase.

LT M. PORVAZNIK was frocked LCDR.

LCDR L. D. NELSON, MSC, USN was transferred to the Defense Personnel Support Activity, Philadelphia, PA.

LT M. PORVAZNIK received the Joint Service Award for work performed at the Armed Forces Radiobiology Research Institute, Bethesda, Maryland.

DT2 G. L. BAILEY was advanced to E-6.

DA W. L. STROUD was advanced to E-3.

JULY

A Change of Command was held at the Naval Dental Research Institute 01 July 1981. Captain M. R. Wirthlin, Jr., DC, USN was relieved by Captain D. W. Turner, DC, USN as the Commanding Officer of the Naval Dental Research Institute.

LCDR F. AKER was made a Fellow of the Academy of General Dentistry.

LCDR D. C. SCHROEDER received a Master of Arts Degree in Health Services Management from Webster College, St. Louis, Missouri.

LCDR W. J. FRY reported for duty from the Naval Regional Dental Center, Great Lakes, IL.

CAPT G. M. McWALTER reported for duty from the Naval Regional Medical Center, San Diego, California.

LT B. R. MERRELL reported for duty from the Naval Medical Research Institute, Bethesda, Maryland.

DTCS R. L. DOUGLASS reported for duty from the Naval Regional Dental Center, Parris Island, South Carolina.

HONORS, AWARDS, POSITIONS HELD, CEREMONIES, STAFF ARRIVALS, DEPARTURES,  
AND REENLISTMENTS (Continued)

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Captain D. W. Turner, DC, USN reading his orders at the Naval Dental Research Institute Change of Command, 01 July 1981. Looking on are Captain W. L. Niederhuth, CHC, USN; Captain J. F. Kelly, DC, USN; Captain M. R. Wirthlin, DC, USN; and Captain G. E. Clark, DC, USN.

AUGUST

Mrs. M. E. CHANDLER was promoted to GS-4 Biological Aid (Microbiology).

CAPT D. W. TURNER was appointed President of a seven member General Court Martial Board.

DT1 J. M. McCORMICK received a Good Conduct Award.

HONORS, AWARDS, POSITIONS HELD, CEREMONIES, STAFF ARRIVALS, DEPARTURES,  
AND REENLISTMENTS (Continued)

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SEPTEMBER

Dr. M. E. COHEN received an Outstanding Performance Award.

Mr. E. P. PEDERSON received a Quality Step Increase.

CAPT G. E. CLARK was appointed Treasurer, Chicago Section of the  
American Association for Dental Research.

Good Conduct Awards were presented to the following personnel:

DT1 S. BENSHOOF

DT1 W. V. REESE

DT2 S. R. HOEFS

UNCLASSIFIED

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